

## REMARKS

### Rejections Under 35 USC §103(a)

Claims 170, 172, 173, 175-178, 263, 265-267 and 270 have been rejected under 35 USC 103(a) as being obvious over Wakabayashi (US Patent No. 6,607,970) in view of Farnworth et al. (US Patent No. 6,620,731) and "Moisture Absorption In No-Flow Underfill Materials And Its Effect On Interfacial Adhesion To Solder Mask Coated FR4 Printed Wiring Board" by Ferguson et al.

Claims 171 and 268 have been rejected under 35 USC 103(a) as being obvious over Wakabayashi (US Patent No. 6,607,970) in view of Farnworth et al. (US Patent No. 6,620,731) and "Moisture Absorption In No-Flow Underfill Materials And Its Effect On Interfacial Adhesion To Solder Mask Coated FR4 Printed Wiring Board" by Ferguson et al. and Beffa et al. (US Patent No. 6,233,185).

Claims 176 has been rejected under 35 USC 103(a) as being obvious over Wakabayashi (US Patent No. 6,607,970) in view of Farnworth et al. (US Patent No. 6,620,731) and "Moisture Absorption In No-Flow Underfill Materials And Its Effect On Interfacial Adhesion To Solder Mask Coated FR4 Printed Wiring Board" by Ferguson et al. and Farnworth et al. (US Patent No. 6,097,087).

Claim 262 has been rejected under 35 USC §103(a) as being obvious over Wakabayashi (US Patent No. 6,607,970) in view of Farnworth et al. (US Patent No. 6,620,731) and "Moisture Absorption In No-Flow Underfill Materials And Its Effect On Interfacial Adhesion To Solder Mask Coated FR4 Printed Wiring Board" by Ferguson et al. and Kinsman et al. (US Patent No. 6,717,245).

Claim 269 has been rejected under 35 USC 103(a) as being obvious over Wakabayashi (US Patent No. 6,607,970) in view of Farnworth et al. (US Patent No. 6,620,731) and "Moisture Absorption In No-Flow Underfill Materials And Its Effect On Interfacial Adhesion To Solder Mask Coated FR4 Printed Wiring Board by Ferguson et al. and Lin (US Patent No. 5,436,203).

Claim 271 has been rejected under 35 USC 103(a) as being obvious over Wakabayashi (US Patent No. 6,607,970) in view of Farnworth et al. (US Patent No. 6,620,731) and "Moisture Absorption In No-Flow Underfill Materials And Its Effect On

Interfacial Adhesion To Solder Mask Coated FR4 Printed Wiring Board by Ferguson et al. and "Functional And Smart Materials" by Wang.

The rejections under 35 USC §103(a) are traversed for the reasons to follow.

#### Summary Of Claimed Subject Matter

Claims 170-179 and 262-271 are directed to a semiconductor component 16 (Figures 4A-4C and 1K) which includes a thinned semiconductor die 10T (Figure 4C) having a circuit side 20 (Figure 4C), a thinned back side 22T (Figure 4C), and a plurality of peripheral edges 30 (Figure 4C). The component 16 (Figures 4A-4C) also includes a first polymer layer (circuit side polymer layer 36P (Figure 4C) and edge polymer layers 40 (Figure 4C) covering the circuit side 20 and the edges 30. The component 16 (Figures 4A-4C) also includes a second polymer layer (back side polymer layer 38P (Figure 4C)) covering the back side 22T.

The component 16 (Figures 4A-4C) also includes a plurality of die contacts 18 (Figure 4C) on the die 10T, and a plurality of contact bumps 24P (Figure 4B) on the die contacts 18 embedded in the first polymer layer 36P (Figure 4C). The component 16 (Figures 4A-4C) can also include terminal contacts 42 (Figure 4C) on the contact bumps 24P. As shown in Figure 8F, the component can also include conductive vias 70A (Figure 8F) in electrical communication with the die contacts 18, and terminal contacts 42A (Figure 8F) on the conductive vias 70A.

#### 35 USC §103(a) Rejections Of Claims 170, 172, 173, 175-178, 265-267 and 270 Over Wakabayashi, Farnworth et al. And Ferguson et al.

The 35 USC §103(a) rejections of claims 170, 172, 173, 175-178, 265-267 and 270 over Wakabayashi, Farnworth et al. and Ferguson et al. are traversed as the rejected claims *taken as a whole* are unobvious over the cited art *taken as a whole*. The test for obviousness is whether the teachings of the prior art, *taken as a whole*, would have made obvious the claimed invention. See *In re Young*, 927 F.2d 588, 591, 18 USPQ2d 1089, 1091 (Fed. Cir. 1991); *In re Keller*, 642 F.2d 413, 425, 208 USPQ 871, 88 (CCPA 1981).

Wakabayashi was cited as disclosing a semiconductor component comprising a semiconductor die (1-Figure 10), a plurality of contact bumps (electrodes 6-Figure 10), a

first polymer layer (seal film 13-Figure 15) covering the circuit side and edges of the die, and a second polymer layer (seal film 17-Figure 15) covering the back side of the die.

Farnworth et al. was cited as disclosing a semiconductor device with a thinned die 10 and conductive vias 34.

Ferguson et al. was cited as disclosing a polymer material comprising a self planarizing thermoset underfill film which is rigidifying.

Although individual features of the present component are known in the art, the claims *taken as a whole* are submitted to be unobvious over the art *taken as a whole*. In particular, a thinned die encapsulated and supported on six sides by polymer layers is submitted to be unobvious over the art. As stated in amended claim 170 "the first polymer layer and the second polymer layer encapsulating the die on six sides and supporting the die, the contact bumps and the peripheral edges".

Claim 170 has also been amended to recite a thickness range of from "10  $\mu$ m to 720  $\mu$ m" for the thinned die. Antecedent basis for this recitation is contained on page 24, lines 19-20 of the specification. This thickness range is critical because the resultant component can have a reduced thickness relative to a conventional component having a full thickness die. The thickness recitations for the first polymer layer and the second polymer layer have been removed from amended claim 170.

Claim 170 was also stated in the Office Action to be a "product by process" claim due to the recitations of "planarized" and "rigidifying". The term "planarized" has been removed from amended claim 170. In addition, the term "rigidifying" has been removed and replaced by the structural recitation "continuous edge polymer layers configured to rigidify the peripheral edges". As held in In re Garnero, 412 F.2d 276, 279, 162 USPQ 221, 223 (CCPA 1979) holding "interbonded by interfusion" to limit structure of the claimed composite and noting that terms such as "welded", "intermixed", "ground in place", "press fitted", and "etched" are capable of construction as structural limitations. It is further noted that the "rigidify" structural limitation provides an improved component because the edges of the thinned die are less prone to crack.

The characterization of the recitations in claims 175 and 270 as being "product by process" is traversed as these recitations further define characteristics of the underfill material rather than the method of manufacture as implied by the Office Action. These

characteristics are critical because they allow the polymer layers to perform the stated function of encapsulating and supporting the thinned die.

The rejections of claims 170, 172, 173, 175-178, 265-267 and 270 under 35 USC §103(a) are further traversed as one skilled in the art at the time of the invention would have no reason to combine the references in the manner of the Office Action. Under the criteria established by *KSR Int'l Co., v. Teleflex, Inc.*, No 04-1350 (U.S. Apr. 30, 2007), in formulating rejections under 35 USC §103(a) it remains necessary to identify a reason why a person of ordinary skill in the art at the time of the invention would have combined references.

With regard to the combination of references the Office Action states: "It would have been obvious ..... to modify the semiconductor Wakabayashi to include a thinned die as disclosed in Farnworth because it aids in exposing conductive members (For Example: See Column 8 Lines 61-67)."

The conductive members 34A are shown in Figure 3F of Farnworth et al. The conductive members 34A provide a conductive path through the substrate 10A from the circuit side to the back side thereof. As shown in Figures 3D and 3E of Farnworth et al., the conductive members 34A are exposed by thinning the substrate 10A. However, in Wakabayashi there are no conductive members to expose, as all of the circuits are on the circuit side of the substrate 1. The proposed reason for the combination of Wakabayashi and Farnworth et al. would not be apparent from a reading of the references, or from background knowledge possessed by a person having ordinary skill in the art.

35 USC §103(a) Rejections Of Claims 171 and 268 Over Wakabayashi, Farnworth et al. Ferguson et al. and Beffa et al.

Claims 171 and 268 recite that the thinned die comprises "a tested and burned in die". Beffa et al. was cited as disclosing a tested and burned in die.

The 35 USC §103(a) rejections of claims 171 and 268 over Wakabayashi, Farnworth et al., Ferguson et al. and Beffa et al. are traversed for essentially the same reasons discussed above with respect to independent claim 170.

35 USC §103(a) Rejection Of Claim 176 Over Wakabayashi, Farnworth et al., Ferguson et al. And Farnworth et al.

Claims 176 recites a ball grid array for the terminal contacts. Farnworth et al. was cited as disclosing a ball grid array.

The 35 USC §103(a) rejections of claim 176 over Wakabayashi, Farnworth et al., Ferguson et al. and Farnworth et al. are traversed for essentially the same reasons discussed above with respect to independent claim 170.

35 USC §103(a) Rejection Of Claim 262 Over Wakabayashi, Farnworth et al., Ferguson et al. And Kinsman et al.

Claim 262 recites materials for the die contacts. Kinsman et al. was cited as disclosing these materials.

The 35 USC §103(a) rejections of claim 262 over Wakabayashi, Farnworth et al., Ferguson et al. and Kinsman et al. are traversed for essentially the same reasons discussed above with respect to independent claim 170.

35 USC §103(a) Rejection Of Claim 269 Over Wakabayashi, Farnworth et al., Ferguson et al. And Lin

Claim 269 recites "the die is contained on a semiconductor wafer having a polymer support dam proximate to edges thereof". Lin was cited as disclosing a polymer support dam.

The 35 USC §103(a) rejection of claim 269 over Wakabayashi, Farnworth et al., Ferguson et al. and Lin is traversed for essentially the same reasons discussed above with respect to independent claim 170.

35 USC §103(a) Rejection Of Claim 271 Over Wakabayashi, Farnworth et al., Ferguson et al. And Wang

Claim 271 recites "the second polymer layer comprises parylene". Wang was cited as disclosing "a semiconductor device that has parylene".

The 35 USC §103(a) rejections of claim 271 over Wakabayahsi, Farnworth et al., Ferguson et al. and Wang is traversed for essentially the same reasons discussed above with respect to independent claim 170.

Conclusion

In view of the amendments and arguments, favorable consideration and allowance of claims 170-179 and 262-271 is respectfully requested. An Information Disclosure Statement is being filed concurrently with this Amendment. Should any issues remain, the Examiner is asked to contact the undersigned by telephone.

DATED this 30th day of April, 2008.

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